AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1-7. (Cancelled)

8. (Currently Amended) A method for depositing a copper-containing seed layer onto a barrier ~~material~~ layer, comprising:

providing a substrate ~~having a~~ comprising the barrier layer disposed on a substrate surface, wherein the barrier layer has a barrier surface selected from the group consisting of a tungsten surface, a tungsten nitride surface, a titanium surface, a titanium nitride surface, a cobalt surface, a ruthenium surface, a nickel surface, and a silver surface;

exposing the substrate to a first copper solution containing complexed copper ions and having a pH value of less than 7, wherein the complexed copper ions are derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivates thereof, and combinations thereof;

applying ~~an~~ a first electrical bias across the substrate surface to chemically reduce the complexed copper ions ~~and~~ to deposit a copper seed layer onto the barrier surface; and

depositing a copper gap-fill layer by:

exposing the substrate to a second copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

9. (Previously Presented) The method of claim 8, further comprising depositing a copper bulk-fill layer by:

exposing the substrate to a third copper solution containing free-copper ions; and

applying a third electrical bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

10. (Original) The method of claim 9, wherein at least one leveling agent is added to the second copper solution to form the third copper solution.

11-19. (Cancelled)

20. (Currently Amended) A method for depositing a copper-containing seed layer onto a barrier ~~material~~ layer, comprising:

providing a substrate ~~having a~~ comprising the barrier layer disposed on a substrate surface, wherein the barrier layer has a barrier surface selected from the group consisting of a tungsten surface, a tungsten nitride surface, a titanium surface, a titanium nitride surface, a cobalt surface, a ruthenium surface, a nickel surface, and a silver surface;

exposing the substrate to a complexed copper solution containing complexed copper ions reducing the complexed copper ions with a first electrical bias to form a copper seed layer on the barrier surface; and

depositing a copper gap-fill layer by:

exposing the substrate to a first copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

21. (Previously Presented) The method of claim 20, further comprising depositing a copper bulk-fill layer by:

exposing the substrate to a second copper solution containing free-copper ions; and

applying a third electrical bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

22. (Previously Presented) The method of claim 21, wherein at least one leveling agent is added to the first copper solution to form the second copper solution.

23-30. (Cancelled)

31. (Currently Amended) A method for depositing a copper-containing seed layer onto a barrier ~~material~~ layer, comprising:

providing a substrate ~~having a~~ comprising the barrier layer disposed on a substrate surface, wherein the barrier layer has a barrier surface selected from the group consisting of a tungsten surface, a tungsten nitride surface, a titanium surface, a titanium nitride surface, a cobalt surface, a ruthenium surface, a nickel surface, and a silver surface;

exposing the substrate to a complexed copper solution containing complexed copper ions derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivates thereof, and combinations thereof;

reducing the complexed copper ions with a first electrical bias to form a copper seed layer on the barrier surface, wherein the first electrical bias has a current density of less than about 10 mA/cm^2 across the substrate surface; and

depositing a copper gap-fill layer by:

exposing the substrate to a second copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.

32. (Previously Presented) The method of claim 31, further comprising depositing a copper bulk-fill layer by:

exposing the substrate to a third copper solution containing free-copper ions; and

applying a third bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer.

33. (Original) The method of claim 32, wherein at least one leveling agent is added to the second copper solution to form the third copper solution.

34-36. (Cancelled)

37. (Previously Presented) The method of claim 8, wherein the copper seed layer is deposited on the entire barrier surface.

38. (Previously Presented) The method of claim 8, wherein the copper source is copper citrate.

39. (Previously Presented) The method of claim 38, wherein the copper solution contains a copper concentration within a range from about 0.02 M to about 0.8 M.

40. (Previously Presented) The method of claim 39, wherein the electrical bias generates a current density of less than about 10 mA/cm^2 across the substrate surface.

41. (Previously Presented) The method of claim 39, wherein the electrical bias generates a current density within a range from about 0.5 mA/cm^2 to about 3 mA/cm^2 across the substrate surface.

42. (Previously Presented) The method of claim 38, wherein the copper seed layer has a thickness of less than about 200 Å.

43. (Previously Presented) The method of claim 38, wherein the pH value is within a range from about 4.5 to about 6.5.

44. (Currently Amended) The method of claim 8, wherein the barrier layer ~~comprises a material selected from the group consisting~~ consists essentially of cobalt, ruthenium, nickel, or tungsten~~, tungsten nitride, titanium, titanium nitride, silver, alloys thereof, and combinations thereof~~.

45. (Previously Presented) The method of claim 20, wherein the copper seed layer is deposited on the entire barrier surface.

46. (Previously Presented) The method of claim 20, wherein the complexed copper ions are derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivates thereof, and combinations thereof.

47. (Previously Presented) The method of claim 20, wherein the complexed copper solution comprises copper citrate.

48. (Previously Presented) The method of claim 47, wherein the complexed copper solution contains a copper concentration within a range from about 0.02 M to about 0.8 M.

49. (Previously Presented) The method of claim 48, wherein the first electrical bias generates a current density of less than about 10 mA/cm^2 across the substrate surface.

50. (Previously Presented) The method of claim 48, wherein the first electrical bias generates a current density within a range from about 0.5 mA/cm^2 to about 3 mA/cm^2 across the substrate surface.

51. (Previously Presented) The method of claim 47, wherein the copper seed layer has a thickness of less than about 200 Å.

52. (Previously Presented) The method of claim 47, wherein the pH value is within a range from about 4.5 to about 6.5.

53. (Previously Presented) The method of claim 31, wherein the copper seed layer is deposited on the entire barrier surface.

54. (Previously Presented) The method of claim 31, wherein the complexed copper solution comprises copper citrate.

55. (Previously Presented) The method of claim 54, wherein the complexed copper solution contains a copper concentration within a range from about 0.02 M to about 0.8 M.

56. (Previously Presented) The method of claim 55, wherein the current density is within a range from about 0.5 mA/cm^2 to about 3 mA/cm^2 across the substrate surface.

57. (Previously Presented) The method of claim 54, wherein the copper seed layer has a thickness of less than about 200 Å.

58. (Previously Presented) The method of claim 54, wherein the complexed copper solution has a pH value within a range from about 4.5 to about 6.5.

59. (Currently Amended) A method for depositing a copper-containing seed layer onto a barrier material layer, comprising:

providing a substrate having a ruthenium barrier layer disposed on a substrate surface~~, wherein the barrier layer has a ruthenium-containing surface~~;

exposing the substrate to a first copper solution containing complexed copper ions and having a pH value of less than 7;

applying ~~an~~ a first electrical bias across the substrate surface to chemically reduce the complexed copper ions and to deposit a copper seed layer onto the ruthenium [[-containing surface]] barrier layer; and

depositing a copper gap-fill layer by:

exposing the substrate to a second copper solution containing free-copper ions; and

applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer.